THE TREND TOWARDS COMMERCIAL SPACE

Commercial Space Emerges

The recently emerging commercial space market is beginning to drive much of the investment in next generation satellites, launch vehicles and spaceport infrastructure. The trend towards commercial space is also influencing NASA's approach to operation, utilization and augmentation of the ISS. Understanding the forces driving space commerce is critical to estimating the potential for commercial utilization of the ISS.

Until recently, government has been the primary driver of the space sector of the economy. The vast majority of dollars invested in the development of satellite systems for positioning, communications and imaging, have come from either civil or military procurement programs. Industry has traditionally been unwilling or unable to embark upon major development programs without the support traditionally provided by a government contract.

In recent years, the model for space development has begun to shift. Government is no longer a monopsony purchaser of services from the aerospace contractor community – rather, numerous commercial systems are now being deployed whose primary customers are businesses or consumers, and not government. This shift is most visible in the Geostationary Earth Orbit (GEO) communications market, which has been developing commercially for several decades. The projected increase in LEO satellites continues to drive much of the investment in the development of next generation launch vehicles.

In the telecommunications area of commercial space, private sector participation has recently surged. The best example of the commercial value of space was seen during the recent Federal Communications Commission (FCC) spectrum auction. Much of the spectrum allocated for space-based communications services was bid for aggressively. The revenue generated during these auctions is a clear indicator of the value the private sector places on commercial activity in space. Over the course of 22 auctions, a total of $23.6B had been committed by over 750 concerns with well over 1,400 having submitted bids (Table 1). While not all of this amount has been collected, due in part to withdrawals and canceled projects, the magnitude of capital in play for space-based telecommunications systems is undeniably significant.

TABLE 1: FCC SPECTRUM AUCTIONS

AUCTION	TYPE OF AUCTION	NET VALUE $	# OF BIDDERS	# WON
Auction 1	Nationwide Narrowband PCS Auction Charts	$650,306,674	27	6
Auction 2	Interactive Video and Data Services (IDVS) Auction Charts	$213,892,375	289	178
Auction 3	Regional Narrowband (PCS) Auction Charts	$394,835,784	28	9
Auction 4	A & B Block Auction Charts	$7,736,020,384	30	18
Auction 5	Block PCS Auction Charts	$9,270,319,265	255	87
Auction 6	Multipoint/Multichannel Distribution Services Auction Charts	$216,397,391	155	67
Auction 7	900 MHz Specialized Mobile Radio Service Auction Charts	$204,399,124	123	80
Auction 8	Direct Broadcast Satellite 110 Degrees (DBS) Auction Charts	$682,500,000	3	1
Auction 9	Direct Broadcast Satellite 148 Degrees (DBS) Auction Charts	$52,295,000	2	1
Auction 10	Broadband PCS C Block Re-auction – Charts	$697,213,950	32	7
Auction 11	Broadband PCS D,E, & F Block Auction Charts	$2,523,428,304	153	125
Auction 12	Cellular Unserved Auction – Charts	$1,842,533	22	10
Auction 14	Wireless Communications Service (WCS) Auction – Charts	$13,639,132	24	17
Auction 15	Digital Audio Radio Service (DARS) Auction – Charts	$173,234,888	4	2
Auction 16	800 MHz Specialized Mobile Radio Service (SMR) Auction – Charts	$96,316,196	62	14
Auction 17	Local Multipoint Distribution System (LMDS) – Charts	$578,749,385	139	104
Auction 18	220 MHz Service – Charts	$21,843,792	54	44
Auction 20	VHF Public Coast Stations Auction – Charts	$7,485,752	8	4
Auction 21	Location and Monitoring Service Auction – Charts	$3,453,308	5	4
Auction 22	C,D,E, & F Block Broadband Auction – Charts	$412,840,945	67	17
Total		$23.6 Billion	1,482	795

Source: FCC

Commercial Satellite Services

The shift toward commercial space is most apparent in the recent development of a wide variety of telecommunication ventures to serve consumers with voice, paging, internet and imagery services. These systems are financed primarily through a combination of private and public equity and debt. Table 2 provides a partial list of the major planned telecommunications systems and the projected investment required for their deployment.

TABLE 2: MAJOR TELECOMMUNICATIONS SYSTEMS

SYSTEM	NUMBER OF SATELLITES	PRIMARY MISSION	COST	OPERATIONAL DATE
Iridium	66	Voice, paging, data, fax	$3.5 billion	Late 1998
Teledesic	288	Broadband internet, high quality voice, computer networking	$9 billion	2003
Globalstar	56	Voice, data, fax	$2.6 billion	1999
ICO	12	Cellular services, fax, paging	$2.6 billion	2000
AceS	2	Voice, data, fax, paging	$900 million	1999
Agrani	2	Voice	$710 million	2000
Orbcomm	48	Data, messaging communications	NA	1995
Skybridge	48	Global broadband telecommunications	$4.2 billion	2001
Spaceway	3	Voice, data, video, audio, multimedia	$1.4 billion	2002

Source: KPMG research, FCC filings, Company publications

The first two operational commercial LEO systems, Orbcomm and Iridium, are currently in the process of building the subscriber base for their respective systems. The success or failure of these companies to reach their financial objectives will test the validity of the market forecasts of unmet worldwide demand for data and communications services that drove the investment in these systems.

Commercial Launch Services

The projected growth in satellite constellations has driven a dramatic increase of activity in the launch services sector. Boeing and Lockheed Martin and numerous privately financed start-up Reusable Launch Vehicle (RLV) companies – such as Pioneer Rocketplane, Kelly Space and Technology, Kistler and Rotary Rocket – all plan to serve the commercial market. In addition to commercial markets, these companies also plan to offer low-cost launch services to the US government. The use of economies of scale and other operational efficiencies will allow these companies to potentially reduce cost of access to space.

Commercial Spaceports

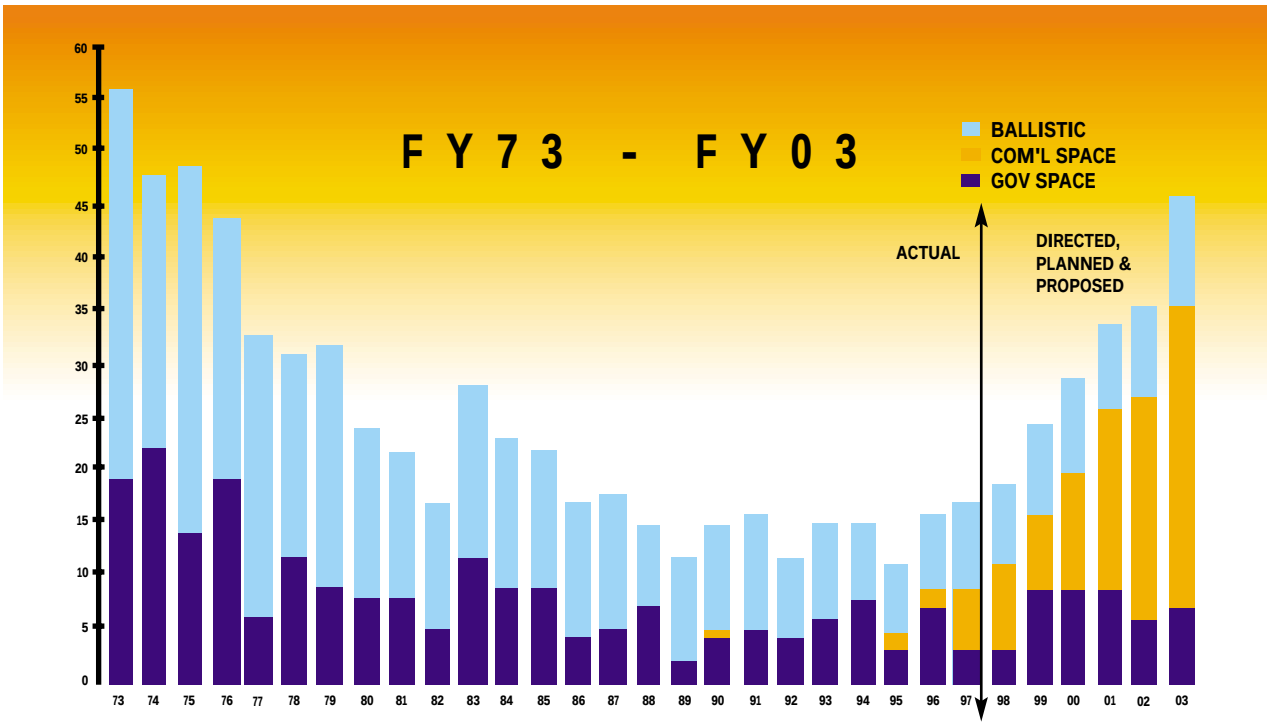
In the past few years, the spaceport market has also seen significant movement towards commercialization. Facilities such as Spaceport Florida, Kodiak Island in Alaska, Wallops Island in Virginia and Space Systems International in California are being developed and operated to service the growing number of satellite launches. In addition, many States and local governmental organizations have been preparing plans to enter into the commercial launch arena in hopes of attracting Lockheed Martin's VentureStar program as its base of operations.

The launch infrastructure segment of the industry value chain has long been dominated by US Air Force and other agencies conducting launch operations at Vandenberg Air Force Base (VAFB) and Cape Canaveral Air Station (CCAS). In the past few years however, a major change has begun to take place within the industry. 1998 marked the first year in which launches of commercial payloads exceeded the number of launches for government payloads from VAFB (Figure 2).

Government's Role in Space

The implications of this shift from majority government customer to majority commercial customer are profound. It indicates that the launch industry may finally begin to emerge as a truly self-reliant sector

FIGURE 2: COMMERCIAL VS. GOVERNMENT LAUNCHES, VAFB



Source: USAF Briefing "Space Infrastructure in California"

that is no longer dependent on direct or indirect subsidization by the US government. Although much of the projected "dominance" of commercial launches in the coming years is predicated on LEO telecommunications systems successfully finding financing, it is clear that the US government is no longer a monopsony purchaser of launch services.

Impact on Commercialization of the ISS

The overall trends toward commercial space that are driving the consideration of commercial utilization of the ISS are as follows:

- The value of commercial space as an operational platform is fairly well understood in the telecommunications market;
- Privatization of space operations through contracts such as SFOC and CSOC are providing a possible path for eventual commercialization of the ISS;
- The market potential for commercial utilization of the ISS may be realized (Figure 3) contingent upon the perceived value of ISS resources exceeding the cost of doing business.

FIGURE 3: ISS COMMERCIAL UTILIZATION TAKE-UP